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Thomas Stafford
4173 Rotherham Court
Palm Harbor, FL 34685

| EXAMINER | |
|---|---|
| THOMPSON, JAMES A | |
| ART UNIT | PAPER NUMBER |
| 2624 | |

DATE MAILED: 08/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/760,924 | JIANG ET AL. | |
| | Examiner | Art Unit | |
| | James A Thompson | 2624 | |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) 1-50 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-50 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 16 January 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell (US Patent 4,989,090) in view of Kawada (US Patent 5,699,499).

**Regarding claims 1 and 26:** Campbell discloses an apparatus (figure 2 of Campbell). Additional details of said apparatus are further shown in figure 3, figure 6A and figure 7 of Campbell (column 4, lines 56-58 and lines 67-68; and column 5, lines 4-6 of Campbell).

Said apparatus further comprises a frame (interfield) interpolator (figure 2(22) of Campbell) for yielding a frame based luminance value for a missing pixel by using frame based interpolation (column 6, lines 35-37 and lines 43-45 of Campbell).

Said apparatus comprising a field (intrafield) interpolator (figure 2(28) and column 7, lines 10-14 of Campbell) for yielding a field based luminance value for a missing pixel (figure 1(i) and column 5, lines 29-32 of Campbell) by using field based interpolation (column 7, lines 10-14 of Campbell). The spatial interpolator (figure 2(28) of Campbell) computes a spatial average of pixels (column 7, lines 10-14 of Campbell) used to interpolate the value of the missing pixel (figure 1(i)

and column 5, lines 29-32 of Campbell) between two known pixels (figure 1(a,b) and column 5, lines 33-36 of Campbell) on the same field (figure 1(F1) and column 5, lines 29-34 of Campbell). Furthermore, the interpolated value is a luminance value of the missing pixel since the pixel data is given as a luminance data stream (column 7, lines 40-42 of Campbell).

Said apparatus further comprises a luminance difference unit (figure 3(32) of Campbell) for obtaining luminance value differences of pixels (column 7, lines 40-45 of Campbell) in prescribed fields of an image (figure 1(F0,F2) and column 7, lines 40-43 of Campbell) in accordance with prescribed criteria (column 7, lines 44-45 of Campbell).

Said apparatus further comprises a motion detector (figure 2(30) and column 7, lines 38-39 of Campbell) supplied with prescribed ones of said luminance value differences (column 7, lines 40-42 of Campbell) for generating a motion metric value at a missing pixel (column 7, lines 53-55 of Campbell).

Said apparatus further comprises a controllable combiner (figure 2(26) of Campbell) supplied with said frame based luminance value (column 6, lines 54-60 of Campbell) and said field based luminance value (column 6, lines 46-48 of Campbell) and being responsive to a representation of said motion metric value (column 6, lines 65-68 of Campbell) to controllably supply as an output a luminance value for said missing pixel (column 6, lines 58-62 of Campbell). As can be clearly seen in figure 2 of Campbell, when the switch (figure 2(26) of Campbell), spatial interpolator (figure 2(28) of Campbell), and motion detector (figure 2(30) of Campbell) are added to the device (column 6, lines 54-58 of

Campbell), the switch determines whether the output of said spatial interpolator or the temporal median filter (figure 2(22) of Campbell).

Campbell does not disclose expressly a spatial median filter supplied with at least three of said motion metric values for determining a median motion metric value.

Kawada discloses a spatial median filter (figure 1 of Kawada) supplied with at least three of said motion metric values (column 3, lines 6-9 of Kawada) for determining a median motion metric value (column 3, lines 1-5 of Kawada).

Campbell and Kawada are combinable because they are from the same field of endeavor, namely filtering, interpolating and processing video image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply the median filter for motion vectors taught by Kawada to the motion vector calculation and processing taught by Campbell. Said controllable combiner would then also respond to a median metric value instead of a single metric value. The motivation for doing so would have been to improve motion vectors of blocks containing boundaries of objects in different motions to provide for satisfactory visual interpolation (column 1, line 67 to column 2, line 3 of Kawada). Therefore, it would have been obvious to combine Kawada with Campbell to obtain the invention as specified in claims 1 and 26.

**Regarding claims 17 and 42:** The arguments regarding claims 1 and 26 are incorporated herein.

Campbell further discloses a look-up table (figure 4 of Campbell) including blending factor values related to said motion metric values (column 7, lines 12-16

of Campbell) and being responsive to supplied motion metric values for supplying as an output corresponding blending factor values (column 7, lines 8-12 of Campbell). The switch (figure 2(26) of Campbell) is used to multiply the intrafield signal (figure 2(29) of Campbell) by a control value of k, said control value being between zero and unity, and the interfield signal (figure 2(23) of Campbell) by (1-k) (column 7, lines 17-22 of Campbell). Said control value is a function of the motion activity (column 7, lines 26-29 of Campbell). Said control value is stored for a specific number of steps, relating the motion amplitude and the fractional value of k (figure 4 and column 7, lines 22-25 of Campbell). Since the k values are stored in memory as a particular number of steps relating quantities, in other words taking the motion amplitude as an input and outputting the corresponding value of k, then said memory storing the specific values of k, which is accessed by the apparatus, constitutes a look-up table.

**Regarding claims 2, 18, 27 and 43:** Campbell does not disclose expressly that said spatial median filter is a nine-value spatial median filter.

Kawada discloses a nine-value (figure 3 and column 3, lines 18-22 of Kawada) spatial median filter (column 3, lines 22-26 of Kawada).

Campbell and Kawada are combinable because they are from the same field of endeavor, namely filtering, interpolating and processing video image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a nine-value filter, as taught by Kawada, for the spatial median filter of Campbell. The motivation for doing so would have been improve motion vectors of blocks containing boundaries of objects in different motions to

provide for satisfactory visual interpolation (column 1, line 67 to column 2, line 3 of Kawada). Therefore, it would have been obvious to combine Kawada with Campbell to obtain the invention as specified in claims 2 and 27.

**Regarding claims 3, 19, 28 and 44:** Campbell discloses that said combiner, in response to said representation of said median motion metric value indicating the image is still, outputs said frame based (interfield) luminance value, and said combiner, in response to said representation of said median motion metric value indicating motion in the image, outputs said field based (intrafield) luminance value (column 6, lines 58-62 of Campbell).

**Regarding claims 4 and 29:** Campbell discloses that said frame based luminance value is generated by said frame (interfield) interpolator in accordance with $C_0=C_{-1}$, where $C_0$ is the luminance value of the missing pixel in field $f_0$ and $C_{-1}$ is the luminance value of a pixel corresponding to the missing pixel in a last prior field $f_{-1}$ relative to field $f_0$ (column 5, lines 40-44 of Campbell), and said field based luminance value is generated by said field (intrafield) interpolator in accordance with $C_0 = \frac{(N_0 + S_0)}{2}$, where $N_0$ is the luminance value of a pixel above and in the same field $f_0$ as the missing pixel, and $S_0$ is the luminance value of a pixel below and in the same field $f_0$ as the missing pixel (column 5, lines 44-45 and lines 50-51 of Campbell). If there is no motion, then the luminance value of a pixel (d) corresponding to the missing pixel in a last prior field (F2) can be used to represent the missing pixel (i) (column 5, lines 40-44 of Campbell). If there is motion (column 5, lines 44-45 of Campbell), the average of the pixel above (a)

and the pixel below (b) the missing pixel (i) is used (column 5, lines 50-51 of Campbell), an average being, by definition, $i = \frac{(a+b)}{2}$. The use of different symbols ($C_0$, $C_{-1}$, $f_0$, $f_{-1}$, $N_0$, $S_0$) to represent the same corresponding physical quantities (i, d, F1, F2, a, b) is simply a matter of notation.

**Regarding claims 5, 12, 21, 30, 37 and 46:** Campbell does not disclose expressly that said luminance difference unit generates a plurality of prescribed luminance value differences of pixels in prescribed fields of the image, and said motion detector employs prescribed relationships of said luminance value differences to generate said motion metric value.

Kawada discloses that generating a plurality of prescribed luminance value differences of pixels in prescribed fields of the image (column 3, lines 5-8 of Kawada), and employing prescribed relationships of said luminance value differences to generate said motion metric value (column 4, lines 30-32 and lines 38-45 of Kawada). A plurality of prescribed motion vectors for pixels are computed, specifically for a neighborhood of pixels (column 3, lines 5-8 of Kawada), which requires the luminance difference of said pixels.

Campbell and Kawada are combinable because they are from the same field of endeavor, namely filtering, interpolating and processing video image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply multiple prescribed calculations of motion metric values for a prescribed set of pixels, as taught by Kawada, said motion metric values calculated using luminance differences, as specifically taught by Campbell. The

motivation for doing so would have been improve motion vectors of blocks containing boundaries of objects in different motions to provide for satisfactory visual interpolation (column 1, line 67 to column 2, line 3 of Kawada). Therefore, it would have been obvious to combine Kawada with Campbell to obtain the invention as specified in claims 5, 12, 21, 30, 37 and 46.

**Regarding claims 6, 13, 22, 31, 38 and 47:** Campbell discloses that said luminance difference unit generates the absolute value (column 7, lines 51-53 of Campbell) of the difference between corresponding pixel luminances in frames F0 and F2 (column 7, lines 40-44 of Campbell) in order to detect motion (column 7, lines 29-32 of Campbell). Since the pixel to be interpolated (i) is in frame F1 (figure 1 of Campbell), F0 and F2 therefore correspond to frames $f_1$ and $f_{-1}$, and c and d correspond to pixels $C_1$ and $C_{-1}$. If the luminance difference for the center pixel is denoted as $\Delta_c$, then said luminance difference of the frame is therefore given as $\Delta_c = |C_1 - C_{-1}|$.

Campbell further discloses that the missing pixel (i) is interpolated as the average of the pixel above (a) and pixel below (b) said missing pixel (column 5, lines 50-51 of Campbell), which would therefore be given by the equation $i = \frac{a+b}{2}$. This relationship could also be expressed as $C_0 = \frac{(N_0 + S_0)}{2}$, where $N_0$ is the luminance value of a pixel above and in the same field $f_0$ as the missing pixel, and $S_0$ is the luminance value of a pixel below and in the same field $f_0$ as the missing pixel, since the change in variable name is a simple matter of notation. Campbell further discloses that the video image data is interlaced

(figure 1 and column 5, lines 36-39 of Campbell), so a corresponding pixel position in every second frame will have to be interpolated in a similar manner. Therefore, the spatially interpolated value for the corresponding pixel position in the field $f_{-2}$, which is the second prior field relative to $f_0$, is given by $C_{-2} = \frac{(N_{-2} + S_{-2})}{2}$, where $C_{-2}$ is the corresponding missing pixel in field $f_{-2}$, $N_{-2}$ is the luminance value of a pixel above and in the same field $f_{-2}$ as the missing pixel ($C_{-2}$), and $S_{-2}$ is the luminance value of a pixel below and in the same field $f_{-2}$ as the missing pixel ($C_{-2}$).

Campbell does not disclose expressly that said luminance difference unit generates a second luminance difference value in accordance with

$$\Delta_a = \left| \frac{N_0 + S_0}{2} - \frac{N_{-2} + S_{-2}}{2} \right|.$$

Kawada discloses obtaining a motion vector of a center pixel (b1) in a block (figure 3(b1) and column 3, lines 18-22 of Kawada).

Campbell and Kawada are combinable because they are from the same field of endeavor, namely filtering, interpolating and processing video image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to also obtain a motion vector (luminance difference) directly from the center pixel, as taught by Kawada. Since, as taught by Campbell, the video image data is interlaced and the center pixel of both $f_0$ and $f_{-2}$ must be interpolated, the resultant motion vector ($\Delta_a$) would be $\Delta_a = \left| \frac{N_0 + S_0}{2} - \frac{N_{-2} + S_{-2}}{2} \right|$.

The motivation for doing so would have been to improve the visual interpolation

field quality (column 2, lines 1-3 of Kawada). Therefore, it would have been obvious to combine Kawada with Campbell to obtain the invention as specified in claims 6, 13, 22, 31, 38 and 47.

**Further regarding claims 7, 14, 23, 32, 39 and 48:** Campbell discloses selecting the largest component of motion values at the vicinity of the pixel to be interpolated (i) (column 7, lines 35-37 of Campbell). For the motion vectors calculated above in the arguments regarding claims 6, 13, 22, 31, 38 and 47, this would cause said motion detector to give a resultant motion metric value ($\Delta$) in accordance with $\Delta = \max(\Delta_c, \Delta_a)$.

**Regarding claims 8, 15, 24, 33, 40 and 49:** Campbell discloses that said luminance difference unit generates the absolute value (column 7, lines 51-53 of Campbell) of the difference between corresponding pixel luminances in frames F0 and F2 (column 7, lines 40-44 of Campbell) in order to detect motion (column 7, lines 29-32 of Campbell). Since the pixel to be interpolated (i) is in frame F1 (figure 1 of Campbell), F0 and F2 therefore correspond to frames $f_1$ and $f_{-1}$, and c and d correspond to pixels $C_1$ and $C_{-1}$. If the luminance difference for the center pixel is denoted as $\Delta_c$, then said luminance difference of the frame is therefore given as $\Delta_c = |C_1 - C_{-1}|$.

Campbell further discloses that the video image data is interlaced (figure 1 and column 5, lines 36-39 of Campbell), so a motion vector will have to take into account the corresponding pixel values in every other frame.

Campbell does not disclose expressly that said luminance difference unit generates a second luminance difference value in accordance with $\Delta_n = |N_0 - N_{-2}|$, where $N_0$ is a luminance value of a pixel above and in the same field $f_0$ as the missing pixel and $N_{-2}$ is a luminance value of a pixel above the missing pixel and in the second prior field $f_{-2}$ relative to the field $f_0$ including the missing pixel, and generates at least a third luminance difference value in accordance with $\Delta_s = |S_0 - S_{-2}|$, where $S_0$ is a luminance value of a pixel below and in the same field $f_0$ as the missing pixel and $S_{-2}$ is a luminance value of a pixel below the missing pixel and in the second prior field $f_{-2}$ relative to the field $f_0$ including the missing pixel.

Kawada discloses calculating motion vectors in a center pixel (figure 3(b1) of Kawada) and the pixels adjacent to said center pixel (figure 3 and column 3, lines 1-5 of Kawada), which therefore includes the pixel above and below said center pixel.

Campbell and Kawada are combinable because they are from the same field of endeavor, namely filtering, interpolating and processing video image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to further obtain motion vectors (luminance differences) for the pixels above and below said center pixel, as taught by Kawada. Since, as taught by Campbell, the video image data is interlaced, the resultant motion vectors ($\Delta_n$,$\Delta_s$) would be $\Delta_n = |N_0 - N_{-2}|$ and $\Delta_s = |S_0 - S_{-2}|$. The motivation for doing so would have been to improve the visual interpolation field quality (column 2, lines

1-3 of Kawada). Therefore, it would have been obvious to combine Kawada with Campbell to obtain the invention as specified in claims 8, 15, 24, 33, 40 and 49.

**Further regarding claims 9, 16, 25, 34, 41 and 50:** Campbell does not disclose expressly that said motion detector generates said motion metric value in accordance with $\Delta = \max(\Delta_c, \min(\Delta_n, \Delta_s))$, where $\Delta$ is said motion metric value.

Kawada discloses using median filtering to determine the motion vector to use for the center pixel, thus eliminating large motion vectors which are the result of noise (column 3, lines 44-50 of Kawada). For the case of using the three motion vectors ($\Delta_c$,$\Delta_n$,$\Delta_s$), as discussed in the arguments regarding claims 8, 15, 24, 33, 40 and 49, said median filtering is expressible in the form $\Delta = \max(\Delta_c, \min(\Delta_n, \Delta_s))$.

Campbell and Kawada are combinable because they are from the same field of endeavor, namely filtering, interpolating and processing video image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply median filtering, as taught by Kawada, to determine the motion vector of the pixel to be interpolated. The motivation for doing so would have been to reduce the effects of noise (column 3, lines 48-50 of Kawada). Therefore, it would have been obvious to combine Kawada with Campbell to obtain the invention as specified in claims 9, 16, 25, 34, 41 and 50.

**Regarding claims 10 and 35:** Campbell discloses a look-up table (figure 4 of Campbell) including blending factor values related to said motion metric values (column 7, lines 12-16 of Campbell) and being responsive to said median motion metric value from said spatial median filter for supplying as an output a

corresponding blending factor value as said representation of said median motion metric value (column 7, lines 8-12 of Campbell). The switch (figure 2(26) of Campbell) is used to multiply the intrafield signal (figure 2(29) of Campbell) by a control value of k, said control value being between zero and unity, and the interfield signal (figure 2(23) of Campbell) by (1-k) (column 7, lines 17-22 of Campbell). Said control value is a function of the motion activity (column 7, lines 26-29 of Campbell). Said control value is stored for a specific number of steps, relating the motion amplitude and the fractional value of k (figure 4 and column 7, lines 22-25 of Campbell). Since the k values are stored in memory as a particular number of steps relating quantities, in other words taking the motion amplitude as an input and outputting the corresponding value of k, then said memory storing the specific values of k, which is accessed by the apparatus, constitutes a look-up table.

**Regarding claims 11, 20, 36 and 45:** Campbell discloses that said controllable combiner is responsive to said blending factor for supplying as an output a luminance value for said missing pixel in accordance with $C_0 = \alpha \frac{(N_0 + S_0)}{2} + (1-\alpha)C_1$, where $C_0$ is the luminance value of the missing pixel in field $f_0$, $C_{-1}$ is the luminance value of a pixel corresponding to the missing pixel in a last prior field $f_{-1}$ relative to the field $f_0$, $N_0$ is the luminance value of a pixel above and in the same field $f_0$ as the missing pixel, $S_0$ is the luminance value of a pixel below and in the same field $f_0$ as the missing pixel and $\alpha$ is the blending factor (column 7, lines 17-22 of Campbell). As discussed above in the

arguments regarding claims 4 and 29, said field based luminance value is generated by said field (intrafield) interpolator in accordance with $C_0 = \frac{(N_0 + S_0)}{2}$ (column 5, lines 44-45 and lines 50-51 of Campbell) and said frame based luminance value is generated by said frame (interfield) interpolator in accordance with $C_0 = C_{-1}$ (column 5, lines 40-44 of Campbell). A control signal (k) is used such that said field based luminance value is multiplied by k and said frame based luminance value is multiplied by (1-k) and the two signals are blended together (column 7, lines 17-22 of Campbell). k can be represented by $\alpha$ since the variables represent the same quantity and the choice between k and $\alpha$ is therefore a simple matter of notation. The equation for the output luminance value for the missing pixel can therefore be represented as

$$C_0 = \alpha \frac{(N_0 + S_0)}{2} + (1 - \alpha)C_1.$$

## *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A Thompson whose telephone number is 703-305-6329. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K Moore can be reached on 703-308-7452. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

James A. Thompson
Examiner
Art Unit 2624

JAT
August 10, 2004

THOMAS D
[illegible] LEE
PRIMARY EXAMINER